Drive and control systems for lift trucks

From the gear pump to electronic lift-truck management
Unique variety for tailor-made systems

When it comes to drive and control systems for lift trucks, Rexroth Mobile Hydraulics offers the customer a unique variety of components and systems for tailor-made solutions. Combustion-engined or electric lift trucks, reach fork-lift trucks or high-lift trucks – Rexroth has the perfect system for your machine’s particular requirements.

With our extensive range, we are in a position to cover the entire spectrum of materials-handling applications. At our Lift Truck Application Centre, specialists from the various product areas work closely together to offer you comprehensive assistance, from selecting the ideal components to planning entire systems.

We provide:

- Hydrostatic drives with hydraulic or electronic control
- Working hydraulics with throttle control or load sensing control
- Hydraulic steering and braking systems
- Mobile electronics for optimum drive management

Look no further

At Rexroth you can find the complete range of drive and control systems for lift trucks – no need to look elsewhere. For the Mobile Hydraulics sector of Bosch Rexroth AG – with its product areas axial piston machines, external gear machines, radial piston motors, mobile control systems, gearboxes, mobile electronics and mobile service – is able to equip each system in its entirety.
Prerequisite for optimum operation
Our high-performance drive and control systems are vital components of these machines, and therefore a basic prerequisite for optimum lift-truck operation. These systems excel, in particular, in their reliability, economy and user-friendliness. Besides hydraulic systems, electronic control systems are increasingly being employed for drives. With working hydraulics as for drives, economy, performance and user-friendliness are in the foreground. In addition to the classical throttle control systems, load sensing systems are becoming ever more popular.

Application Centre:
**system advice, project planning and optimisation**
Rexroth's Application Centres have the task of analysing present-day and future customer requirements in the field of drive and control technology and working on appropriate solutions – from individual components to the entire system.

Top of the class
The future belongs to vehicles and machines that are more productive, more rapidly available and lower in price. This gives rise to the need, among other things, for drive systems which have been optimised for each specific application. At our Lift Truck Application Centre, we offer the necessary expertise for each application, plus state-of-the-art simulation programs and powerful test systems. In close co-operation with our customers and partners, ready-to-operate systems with perfectly matched components are elaborated with the minimum of interfaces. In addition, our Application Centres exploit the synergy factor of the divisions of Bosch Rexroth AG, each oriented towards a different type of technology.

Close to you – world-wide
The Rexroth sales network extends throughout 86 countries all over the globe. Further, we can boast 45 sales and service centres of our own in 36 countries, plus 85 production plants on a global scale. In this way, qualified partners are at your side practically the world over when it comes to drive and control systems.
Economic solutions for individual operating conditions

The majority of vehicles for material transport in the company are fork-lift trucks with combustion engines. Systems for driving and working hydraulics are as varied as the lift trucks themselves. Efficient load sensing control systems for the lifting functions and the steering system are becoming increasingly popular in modern industrial lift trucks. These systems satisfy today’s more exacting requirements with regard to ergonomics and energy consumption, and are capable of achieving the greater levels of performance now required in modern logistics systems. The Rexroth hydrostatic drive is the superior drive technology for fast work and optimum driving comfort in the tough everyday life of the industrial lift truck.

Open centre working hydraulics
Open centre working hydraulics constitute a tough system that has been tried and tested over many years. Reliability, a simple construction and compact design are its principle advantages.

Hydrostatic drive with hydraulic control system
Hydrostatic drives are the ideal drives for a modern combustion-engined lift truck and ensure a high degree of efficiency. The stepless power transmission and automotive driving properties of the non-wearing hydrostatic drive with hydraulic control system cannot fail to convince.
Load sensing working hydraulics

Load sensing systems for working hydraulics naturally achieve the main development goals for modern lift-truck concepts – such as lowering the energy consumption whilst simultaneously increasing performance and improving user-friendliness.

The demand-oriented supply to the steering and tower hydraulics ensures that the energy required by the working hydraulics is consistently lowered. Since functions such as lifting and tilting can be operated in parallel, high performance levels are achieved. The load-independent actuating forces of the directional control valve functions ensure high-precision, fatigue-free working.

Hydrostatic drive with electronic lift-truck management

Accelerate rapidly, brake sharply, reverse, set off gently, slow down gradually. The beverage industry, a steelworks or the haulage business. The range of applications for these machines could scarcely be broader. But thanks to electronic lift-truck management, different driving characteristics can be selected for different operating conditions. This drive can also be distinguished by its low noise and consumption, achieved by incorporating the combustion engine in the lift-truck management system. Here, the constant speed drive and lift speed function are extremely impressive.
The right drive for hard terrain

Off-road lift trucks are characterised by high ground clearance, off-road tyres and – in some vehicles – an optional differential lock. Economy, manoeuvrability and high performance are also in the foreground. Traditionally, off-road lift trucks have rear-wheel drive, while some manufacturers also produce machines with centre-pivot steering. All requirements and tasks demanded of the hydraulic system in off-road lift trucks can be amply satisfied in an optimum fashion by the Rexroth product range. For example, we offer hydrostatic drives that are designed for different bearing forces and are equipped with the corresponding drives for mastering these forces.

Hydrostatic drive
The task of the hydrostatic drive for off-road lift trucks is, above all, to prevent the wheels spinning and thereby a loss of traction during off-road operation. To this aim, Rexroth offers either the axle drive with axial piston motor or the single-wheel drive with wheel gearbox.

Axle drive with axial piston motor
The standardised drive consists of a variable displacement pump and an actuating motor which is flange-mounted directly to a ring and pinion. A mechanical differential lock prevents the wheels from spinning on uneven and slippery ground. Traction is maintained one hundred percent. The drive can be either hydraulically or electronically controlled.

Single-wheel drive with wheel gearbox
In vehicle designs in which axle drive is impossible, the single-wheel drive with actuating motors and an electronic anti-slip control provides the solution for off-road operation. Here, two wheel gearboxes each with a flange-mounted axial piston motor are employed. The electronic control unit monitors the motor revolutions and compensates them if they deviate too far from setpoints. In this way, impaired traction is prevented.
Systems for working hydraulics

Two types of system are available for the working hydraulics of off-road lift trucks: open centre systems with gear pumps and load sensing systems with constant or variable displacement pumps.

Open centre system

Open centre systems with gear pumps are well-proven and robust, and impress through their compact, sturdy construction. The directional control valves can be mechanically, hydraulically or electrohydraulically operated and, additionally, offer a multitude of possibilities when it comes to combination.

Load sensing system

In load sensing systems with variable displacement pump, oil is supplied to the system – comprising a brake, steering system and control block – by a pump. The quantity supplied by the pump varies with the changing demand as a result of the LS signal fed back to the pump. At the same time, a priority valve ensures that the brake and steering system have priority. Advantages of this system are the demand-oriented supply to consumers and the load-independent flow distribution. Sensitive operation, electric actuation via CAN bus and an extremely good thermal characteristic are further benefits of this system.
The special drive

Compact in design, easy to operate and highly functional – when it comes to drive and control systems for portable lift trucks, too, Rexroth can offer well thought-out components and solutions. In addition to the tried-and-tested hydraulic drive, Rexroth's patented anti-slip system, for example, is also ideal.

Hydrostatic drive
The Rexroth automotive drive with load-limit sensing control, with designs that have deliberately been kept simple, offers customers a convincing competitive advantage. Rexroth offers designers the choice of either the standard multi-motor gear drive or – for efficiently making the most of available power – the Rexroth anti-slip system.
Multi-motor gear drive
A typical component of the multi-motor gear drive is the flow divider, which acts as a hydraulic differential lock and prevents individual wheels from spinning, for example, when working off-road.

Rexroth anti-slip system
This system patented by Rexroth dispenses with the flow divider in favour of an improved arrangement of components and tubing. In this way, flow losses are kept to a minimum, enabling the power of the overall drive to be exploited to the full. Thus, even with hydraulic components of the same power, greater traction is available in this system than in the above standard drive with flow divider.
Precise, energy-saving systems for electric lift trucks

Due to their limited battery capacity, electric lift trucks and high-lift trucks have to rely upon low energy consumption despite high performance requirements. For this reason, modern electric lift trucks employ pulse control systems for the lifting and steering hydraulics. Among other things, these ensure energy-saving, low-noise operation. In high-lift trucks, compact power units are ideal for meeting criteria such as reliability and ease of operation.

**Recognition of functions**
Factory-calibrated, non-contact sensors situated on the directional control valve block and the steering column ensure a demand-oriented supply to the steering or tower hydraulics functions. This is achieved by means of one or two variable-speed, noise-reduced Silence gear pumps. An important factor in this process is the conversion of the mechanical spool stroke and steering motion into a proportional electrical signal for the pulse control system.

**Functions as a competitive advantage**
The pulse control system ensures energy-saving, low-noise operation by means of demand-oriented flow control. This technology means that the tower and steering hydraulics can be operated with maximum sensitivity. Electrical signal transmission takes place by means of factory-calibrated, non-wearing sensors, without the need for additional drive and adjustment elements. Moreover, we offer an extensive array of possibilities for further optimising your system. Ancillary functions, such as secondary valves and mutually tuned components, can also be integrated.
**Systems for high-lift trucks**
These days, fork-lift trucks and high-lift trucks are indispensable assistants in the fields of production and retail. Besides ever more demanding requirements by operators in terms of ergonomics and the reliability and robustness of equipment, functional, good-value systems are also of vital importance to manufacturers. Compact power units satisfy these requirements one hundred percent, for the Rexroth system is tough, ready-to-install and suitable for a great variety of applications.

**Efficient and highly precise**
Hydraulic units consisting of an electric motor, gear pump, oil tank and variously equipped valve blocks are employed. These units can be augmented by the addition of manufacturer-specific options, including valve electronics. Particularly worthy of note is the lowering function with electric proportional control from the drawbar, enabling highly sensitive lowering and positioning with pin-point accuracy. The low flow resistance permits an especially high lowering speed – even with low loads. This considerably increases the working efficiency of the high-lift truck.

**Compact and ready-to-install**
Rexroth offers ready-to-install compact power units which do not require preassembly by the manufacturer. The modular design of this sturdy, reliable technology offers a variety of possibilities for different units and bearing-force classes. Furthermore, compact power units provide a multitude of opportunities for system optimisation. In this way, options such as ancillary valves, manufacturer-specific tank shapes and fastening elements can be integrated without problem.
### Components at a glance

Axial piston machines, external gear machines, radial piston motors, mobile control systems, gearboxes and mobile electronics – look no further, Rexroth has it all.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Nominal pressure</th>
<th>Maximum pressure</th>
<th>Catalogue page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Axial piston pump A4VG (A10VG)</strong></td>
<td>for closed circuits</td>
<td>400 (300) bar</td>
<td>450 (350) bar</td>
<td>RE 92 003 (92 750)</td>
</tr>
<tr>
<td><strong>Axial piston motor A6VM</strong></td>
<td>for open and closed circuits</td>
<td>up to 400 bar</td>
<td>up to 450 bar</td>
<td>RE 91 604</td>
</tr>
<tr>
<td><strong>Radial piston motor MCR</strong></td>
<td>for open and closed circuits</td>
<td>up to 250 bar</td>
<td></td>
<td>RE 15 205</td>
</tr>
<tr>
<td><strong>Drive GFT</strong></td>
<td>with axial piston actuating motor A6VE</td>
<td></td>
<td>7 – 330 kNm</td>
<td>RE 77 110</td>
</tr>
<tr>
<td><strong>Axial piston pump A10VO</strong></td>
<td>for open circuits</td>
<td>250 bar</td>
<td>315 bar</td>
<td>RE 92 703</td>
</tr>
<tr>
<td><strong>External gear pump</strong></td>
<td>Constant displacement pumps in standard and Silence versions</td>
<td>250 bar</td>
<td>280 bar</td>
<td>1 987 760 100</td>
</tr>
<tr>
<td><strong>Control block SM12</strong></td>
<td>mechanically operated</td>
<td>70 l/min</td>
<td>250 bar</td>
<td>RE 64 122</td>
</tr>
<tr>
<td><strong>Control block SB12LS</strong></td>
<td>mechanically operated</td>
<td>80 l/min</td>
<td>250 bar</td>
<td>1 987 760 512</td>
</tr>
<tr>
<td><strong>Control block SB12LS-EHS</strong></td>
<td>electrohydraulically operated, with on-board electronics</td>
<td>80 l/min</td>
<td>250 bar</td>
<td>1 987 760 512</td>
</tr>
<tr>
<td><strong>Control block SB1-OC</strong></td>
<td>integrated inductive position sensors for measuring the spool travel</td>
<td>30 l/min</td>
<td>70 l/min</td>
<td>1 987 760 514</td>
</tr>
</tbody>
</table>
Electrohydraulic pump EHP
Drive unit for automotive and materials-handling technology
Nominal capacity up to 11.5 kW
Displacement up to 19 cm³
Catalogue 1 987 760 401

Compact power unit EP9
with proportional technology
Preassembled hydraulic unit
Nominal pressure 210 bar
Displacement up to 4.6 cm³
Catalogue 1 987 760 407

Hydrostatic steering unit LAGC/LAGU/LAGZ
for steering
Catalogue page RE 11 867, RE 14 365, RE 11 868

Steering column LAB
with sensor LAB
for digital and analog signal transmission
Catalogue page RE 11 874

Priority valve LPS
for the demand-sensitive supply of steering units
Catalogue page RE 27 548

Accumulator-charging valve LT06
for supplying the hydraulic service brake
Catalogue page RE 64 191

1-circuit footbrake valve LT05
for highly sensitive operation of the service brake
Catalogue page RE 66 145

Diaphragm-type accumulator
0.075 to 2.80 l
Catalogue 1 987 761 403

Electric joystick M-Control
Signal transmitter for 2 axes with or without CAN bus interface
Catalogue page RE 29 886

Control unit RC
for closed-loop and open-loop control of hydrostatic drives and working-hydraulic functions
Catalogue page RE 95 051
Future prospects for extended functions

Today, systems such as electronically controlled hydrostatic drives and electronic hitch control EHR for tractors are the state of the art in the most varied array of applications. Likewise, the lift trucks of tomorrow will be considerably influenced by systems intended to increase benefits to customers and reliability in operation. Factors such as variable tilting speeds, vibration damping and load-torque limitation will determine the development of future systems. Rexroth is facing up to these requirements and is already working on ideas for the expansion of functions in drive and control systems for the lift trucks of tomorrow.

Components for increasing the range of functions

- Load-torque limitation
- Variable tilting speed
- Vibration damping
- Cornering stability
- Automatic work sequences

Making the most of new possibilities

These examples from our glance into the future of tomorrow’s lift trucks all show one thing: that the combining of specialist knowledge is of particular importance in the implementation of future systems. Experience has shown that the matching of individual components plays a central part in the optimisation of the overall function. Thus for many years Rexroth has been encouraging intensive cooperation with lift-truck manufacturers. Always with the aim of developing systems to increase benefits to customers and reliability.
The future starts here

Digital control units for actuating the working hydraulics and the drive act as an extended lift-truck management system, with interfaces via CAN bus to the engine management system, assisted by sensors that provide constant information about the load and driving conditions of the lift-truck. Driver assistance through optical and acoustic signals and cautious intervention in functions such as the reduction of tilting speed as a function of the lifting height, for example, increase the lift-truck's performance without impairing function.

Comfort functions such as active and passive vibration damping and the automation of functions and motion sequences reduce driver fatigue, ensuring greater safety and work efficiency. Permanent, background monitoring of load and driving conditions ensures safety and reliability, allowing the machine to be used as far as physical limitations permit.

"The inclusion of additional technical features can only be achieved by increasing the benefit to customers and reliability in operation."